INTRODUCTION

Spiranthes diluvialis (Ute ladies' tresses) has been listed as Threatened under the Endangered Species Act since 1992. Prior to 1997, it was known from scattered locations in Colorado, Utah, Montana, and Wyoming. In 1997, three populations were discovered in riparian and wetland habitats along the South Fork of the Snake River in eastern Idaho. Subsequent searches from 1997-2000 have yielded 21 occurrences (and one tentative occurrence). From 1997 to 2001, population and habitat monitoring of all known *Spiranthes diluvialis* occurrences on the South Fork was conducted with cooperation between the Conservation Data Center (CDC), Bureau of Land Management (BLM), and Caribou-Targhee National Forest (Moseley 2002; Murphy 2002b).

In 1998, research to accurately describe the habitat of *Spiranthes diluvialis* began. The following year, it expanded to incorporate floodplain research by Mike Merigliano (1996) of the University of Montana and BLM (Moseley 1998). The research aims to understand the primary successional pathways and the relationships between fluvial geomorphology, riparian community ecology, and river management in *Spiranthes diluvialis* habitat (Murphy 2002b).

After habitat and population monitoring in 2000, it was determined that a more systematic and objective method of monitoring *Spiranthes diluvialis* was needed (Murphy 2002a). Annual monitoring of *Spiranthes diluvialis* on the South Fork of the Snake River has in the past relied on counting the observable population of flowering individuals and making notations regarding threats and habitat conditions at each occurrence (Moseley 1998, 2002). However, the flowering population of *Spiranthes diluvialis* is naturally highly variable year to year and counting plants is inadequate for determining long-term population (and meta-population) viability trends. For example, annual climate fluctuations may alter the phenology of *Spiranthes diluvialis*, creating the potential for mis-timed surveys. Plant counts alone tell us little about the condition or viability of *Spiranthes* habitat. In addition, subjective notations on habitat quality may reflect observer bias and do not provide a good reference point from which to measure changes to *Spiranthes diluvialis* habitat.

In 2001, systematic, easily repeatable monitoring methods for measuring changes and threats to the habitat of *Spiranthes diluvialis* were developed, tested, and implemented. The monitoring methods were inspired by a Habitat Integrity Index (HII) method developed for monitoring slickspot peppergrass (*Lepidium papilliferum*), a Candidate species in the sagebrush-steppe of southwest Idaho (Mancuso and Moseley 1998). These monitoring methods use an index of habitat change, incorporating what we have learned about *Spiranthes diluvialis* habitat characteristics and the effects of disturbance.

Indices of Biotic Integrity (IBI) and similar methods of measuring ecosystem health have long been used to monitor biological and ecological conditions, mainly in aquatic systems (Angermeier and Karr 1986; Hughes and Noss 1992; Roth et al. 1996; and many more), but also in terrestrial systems (Schaeffer et al. 1988; Smith et al. 1995; Karr 1997). IBI measure the specific responses of organisms to human disturbances. Specifically, indices measure changes in habitat quality and ecological processes (Karr 1997). A HII is an outgrowth of IBI—instead of looking at specific organism responses (which are not always apparent with plants) it looks at habitat. Like IBI, it uses a relative scale with numeric values reflecting changes to habitat quality (Mancuso and Moseley 1998). Similar indices have also been developed for evaluating riparian and wetland health and function (Cowley 1992; Smith et al. 1995).

It is assumed that *Spiranthes diluvialis* generally requires ecologically intact riparian and wetland floodplain habitat with certain characteristics and specific disturbance levels for population health. Thus, an index of habitat change, analogous to a HII, incorporating these attributes can be applied. Importantly, such an index is holistic and realizes that populations respond to the cumulative impacts of habitat disturbance (Karr 1997). For example, we cannot always predict the exact response of *Spiranthes diluvialis* to a single disturbance such as human trampling, but we do know that certain combinations of disturbances are probably negative (e.g., heavy trampling and grazing while plants are above ground (removing flowering individuals), plus bank erosion (removing habitat)).

Twenty-three permanent monitoring transects were established at 18 *Spiranthes diluvialis* occurrences on public land during the last half of August 2001. An occurrence is a standard database device used throughout the Natural Heritage/Conservation Data Center network for tracking rare species. Species occurrences represent specific geographic locations and their delineation is based predominantly on biological data, but also account for environmental or other factors; an occurrence is often not equivalent to the biological definition of a population. The data collected provide a reference point for annually measuring future environmental change at both the population and landscape levels. An index of habitat change was used that involves the measurement of specific habitat attributes important for the persistence of *Spiranthes diluvialis*. The index integrates what we have learned about *Spiranthes diluvialis* habitat from prior vegetation sampling as well as current floodplain dynamics and vegetation succession modeling. The measurements of habitat features use a relative scale, yielding cumulative values representing current habitat conditions at each transect. If those conditions change, the cumulative values change. In addition, repeatable photo-points were established. Much of the information collected this year was incorporated in "Ute ladies' tresses (*Spiranthes diluvialis*) in Idaho: 2001 Status Report" (Murphy 2002b).

Monitoring *Spiranthes diluvialis* is a challenging, but important, task necessary for conservation planning. This habitat monitoring method aids land managers in systematically documenting the long-term effects of livestock grazing, recreation activities, and other direct and indirect threats to occurrences of Ute ladies' tresses on the South Fork of the Snake River. The results of monitoring can provide information pertinent to assessing: the long-term viability of both individual populations and the meta-population; the status of the occupied habitat; any disturbances or threats to the *Spiranthes diluvialis* occurrences; the effects of current and proposed management and conservation actions in occupied habitat; and conservation actions needed at the occurrences. The method may also be applicable to Ute ladies' tresses occurrences in other states.

METHODS

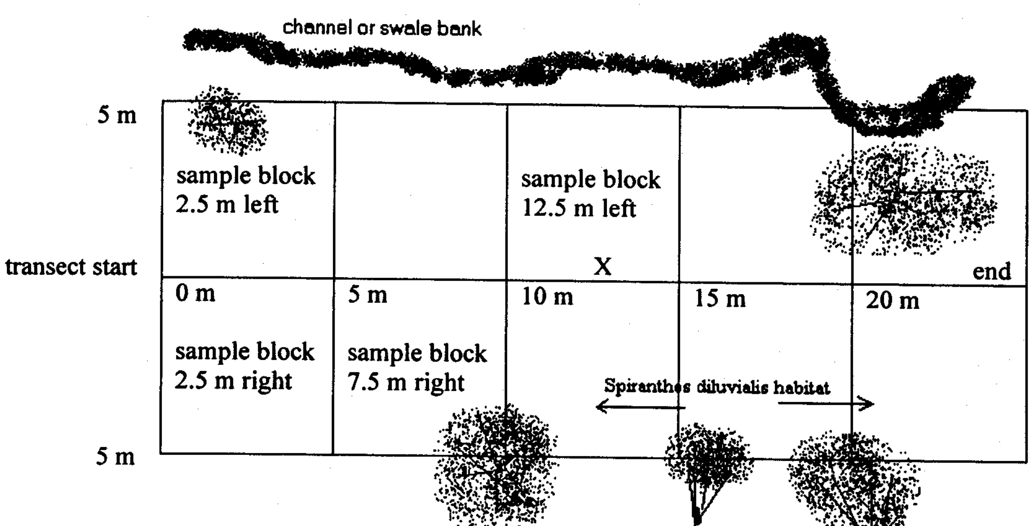
Detailed steps for transect establishment, photo-point monitoring, and habitat monitoring are listed and explained in Appendix 1. The equipment required for these procedures is also listed. Appendix 1 can be reproduced for use in the field.

Transect Establishment Procedure -Transect start locations were subjectively chosen, based on occurrence data (from the CDC database), maps, and on-the ground observations. Transects preferably met the following criteria: were placed in large *Spiranthes diluvialis* sub-populations; represented the range of plant community types and fluvial landform settings at different occurrences; captured both degraded and high quality habitat; and were adjacent to land uses or impacts likely to cause changes to *Spiranthes diluvialis* habitat. Two transects were established at large or heterogeneous occurrences with variable threat levels. Transects were placed to run lengthwise through the center of the *Spiranthes diluvialis* sub-population in question. Sub-populations of *Spiranthes diluvialis* are often linear-shaped and oriented parallel to the fluvial features (e.g., channel, moist swale, terrace, etc). They are also usually in the middle (transitional zone) of the moisture gradient from wet (e.g., seasonally to semi-permanently flooded river channel, backwater slough, or wet swale) to dry (e.g., intermittently flooded cottonwood/dry bar). There were exceptions to this (e.g., a large sub-population at Annis Island (006A)) and best judgment was used when establishing transects in these locations.

Transects were in the form of rectangular belts, with a tape forming a central baseline. The belt transects were of variable length (rounded to the nearest 5 m), but limited to no more than 50 m and no less than 20 m in length (preferably 25 to 40 m). The width was fixed at 5 m on each side of a center baseline (totaling 10 m wide), unless the total width of the habitat being monitored was less than 8 m. If habitat was less than 8 m, then the width was 2.5 m on each side of the baseline (e.g., at Mud Creek Bar (009) and Gormer Canyon #3 (021)). The lengths and widths were chosen to create 5x5 m sampling blocks on each side of a center baseline (Figure 1). The 10 m total width was designed to capture changes at the edges of the *Spiranthes diluvialis* sub-population's habitat. It was okay if the belt transect encompassed small areas outside of the sub-population's habitat (e.g., water, upland vegetation) because the edges are where habitat changes occur (e.g., contraction or expansion of suitable habitat). The transect start was ideally located within about 5 m of the starting and ending habitat edge.

The start of each transect was permanently marked with a rebar stake. The location of the rebar was measured with a navigation grade Global Positioning System (GPS) unit. Text directions to the rebar location were also written. Because rebar markers are susceptible to covering by alluvium or removal by humans, back-up markers were needed. Tree tags, combined with the GPS recordings, were utilized as a backup for relocating transects for future monitoring if the rebar cannot be found. The nearest large cottonwood or juniper tree on higher ground, or any other suitable landmark that will most likely remain fixed for a long period of time (e.g., a fencepost), was marked with an aluminum tree tag and an aluminum nail. The compass bearing (declination corrected to quad map) and distance from the tree tag to the rebar was recorded. The transect tape was then laid out in a straight line to the desired length. The compass bearing and length was recorded. All data (e.g., GPS recordings of rebar and tree tag, length of transect, and compass bearing from rebar to end, and text directions to the rebar location) were recorded on the Transect Establishment and Environmental Description Data Form (modified from Mancuso and Moseley 1998; Elzinga et al. 1998). A field useable copy of this form is located in Appendix 2.

Figure 1. Schematic diagram showing the layout of a typical 25 m long habitat monitoring transect.



X = half-way point where photos are taken and landscape attributes are evaluated.

Photo-Point Monitoring Procedure -At the half-way point of each transect, a series of four photos were taken. Photos were taken in the following order: 1) from the center of the transect toward the end, along the transect bearing; 2) 90 degrees from the transect bearing (right side); 3) 180 degrees from the transect bearing (toward the start); 4) 270 degrees from the transect bearing (left side). Photos were general habitat overviews, but not close-ups. A reference point was included in the foreground (e.g., a shrub), as well as in the background (e.g., a landmark on the horizon, such as a ridgeline or tree). Photos were taken with a "point and shoot" instant camera set to the widest lens angle possible. Photo-point methods were adapted from Mancuso and Moseley (1998) and Elzinga et al. (1998). The annual monitoring photos are on file at the Caribou-Targhee National Forest, Upper Snake River District BLM, and CDC.

Habitat Monitoring Procedure - A checklist of direct and indirect habitat changes and threats, both human caused and natural, was developed for the index of habitat change (a complete field copy of the *Spiranthes diluvialis* Habitat Monitoring Checklist is found in Appendix 3). These habitat attributes were divided into direct and indirect categories. The checklist was developed by utilizing descriptions of habitat conditions supporting *Spiranthes diluvialis* occurrences on the South Fork of the Snake River (Moseley 1998, 2002; Murphy 2002a). The checklist is a list of important habitat attributes (i.e., habitat characteristics, habitat changes, habitat threats) that are assumed to affect the persistence of *Spiranthes diluvialis*. Measurable indicators, or surrogates, for the habitat attributes were assigned numeric value classes reflecting different conditions. These attributes were evaluated at both the transect scale (within the 5x5 m sample blocks) and the landscape scale (at the half-way point of the transect). For all attributes (except the population tally, which included four classes), the numeric values were zero, one, or two. The zero class was the closest to the ideal *Spiranthes diluvialis* habitat conditions; the higher the number, the less ideal the current habitat conditions were. Habitat data values were entered into the appropriate field on the *Spiranthes diluvialis* Habitat Monitoring Tally Sheet (a field copy is found in Appendix 4). These numeric values contributed toward index output values (means for each attribute and a cumulative mean for the transects). If the habitat attributes change over time, then the output values should reflect the direction and magnitude of that change. The following is an outline of the habitat attributes measured and the rationale for their inclusion. Refer to Appendix 3 for more details.

*** DIRECT THREATS AND CHANGES TO HABITAT:**

Hydrologic and Fluvial Geomorphic Change:

1) Bank erosion: Some *Spiranthes diluvialis* occurrences are threatened by actively eroding cut-banks, meander widening, and flood scouring (Murphy 2002a). The distance from the center of the transect to the nearest actively eroding river channel bank was measured to track the rate of erosion at vulnerable occurrences.

2) Deposition: The floods of June 1997 deposited unconsolidated silt, sand, gravel, cobble, or woody debris on some *Spiranthes diluvialis* occurrences (Moseley 1998). If deposits are too deep, *Spiranthes diluvialis* does not apparently survive. The depth of recent alluvium deposited within the last 10 years was measured (if greater than a trace) in the sample blocks. Recent alluvium is minimally vegetated by pioneer species (much loose sand or rocks are visible).

3) Loss of soil moisture at capillary fringe: Vegetation data collected from *Spiranthes diluvialis* occurrences was analyzed to determine general habitat characteristics. The total cover of mesic graminoid species was always 40% or more (Moseley 1998, 2002; Murphy 2002b). Their presence reflects a specific moisture regime in which *Spiranthes diluvialis* prefers to grow. If the site dries due to sand deposition, river down-cutting and a subsequent drop in water table, or other causes, this loss of soil moisture should be reflected in the change in mesic graminoid cover. The total cover of all mesic graminoid species typically associated with *Spiranthes diluvialis* was measured in the sample blocks. These mesic graminoid species included, but were not limited too: *Agrostis stolonifera* (redtop), *Carex lanuginosa* (woolly sedge), *Carex nebrascensis* (Nebraska sedge), *Eleocharis palustris* (creeping spikerush), *Juncus balticus* (Baltic rush), *J. ensifolius* (daggerleaf rush), *Muhlenbergia* spp. (muhly), *Phalaris arundinacea* (reed-canary grass), and *Poa pratensis* (Kentucky bluegrass).

Invasive and Noxious Weeds:

4) Invasion and colonization of noxious and invasive weedy species: Prior monitoring recognized increased competition from weedy species, both native and exotic, as a threat to *Spiranthes diluvialis* (Moseley 2002; Murphy 2002a, 2002b). The total cover of all highly invasiveand noxious weed species (designated under the Idaho Noxious Weed Law) typically associated with *Spiranthes diluvialis* was measured in the sample blocks; relative abundance was measured on the landscape level. These species included, but were not limited too: Agropyron repens (quackgrass), *Bromus inermis* (smooth brome), *Carduus nutans* (musk thistle), *Centaurea* *diffusa* (diffuse knapweed), *C. maculosa* (spotted knapweed), *Cirsium arvense* (Canada thistle), *C. vulgare* (bull thistle), *Euphorbia esula* (leafy spurge), *Phalaris arundinacea* (reed-canary grass), *Sonchus arvensis* (perennial sow-thistle), and *Tanacetum vulgare* (common tansy). *Agrostis stolonifera* (redtop) and *Poa pratensis* (Kentucky bluegrass) were not considered because they are nearly always associated in large amounts with *Spiranthes diluvialis* on the South Fork. For this reason, these exotic grasses are assumed not to pose a short-term threat to *Spiranthes diluvialis* habitat. The long-term effect is not well understood (Moseley 1998).

Livestock Grazing Impacts:

5) Hoofprints and scat piles: Cattle (or other livestock) hoofprints and scat piles from this year are indicators of the magnitude and duration of livestock grazing in *Spiranthes diluvialis* habitat. The number of obvious livestock hoofprints and scat were counted in the sample blocks.

6) Forage utilization: Livestock grazing during the period when *Spiranthes diluvialis* is above ground increases the risk of direct consumption and trampling of *Spiranthes diluvialis* plants (Moseley 1998). The utilization of graminoids (reflected by the stubble height) is an indicator of the amount and intensity of recent grazing (Cowley 1992). Stubble height (of leaves, not inflorescences) was measured in the sample blocks.

7) Trails and bedding: In intensively grazed areas, cattle often form trails and beds that are repeatedly used. Trails and beds can alter site conditions or directly impact *Spiranthes diluvialis*. Vegetation may be trampled on lightly used trails or beds or reduced in highly compacted areas (Murphy 2002a). Trampled vegetation and/or bare ground (excluding rocks) obviously exposed by livestock trailing or bedding was measured in the sample blocks.

Off-Highway Vehicle Use Impacts:

8) Tracking and trailing through population areas: Off-highway vehicles (OHVs) occasionally travel in *Spiranthes diluvialis* habitat (Murphy 2000, 2001). Repeated use leads to trails with crushed or missing vegetation, both potentially detrimental to *Spiranthes diluvialis* survival. The number of recent tracks and trails caused by OHVs (including, but not limited to, all-terrain vehicles, motorcycles, mountain bikes, and 4x4 vehicles) within *Spiranthes diluvialis* habitat was measured in the sample blocks, as well as at the landscape scale.

Recreation:

9) Human trails: Recreation use on the South Fork of the Snake River is growing. One of the most common results of recreation are trails created by anglers, boaters, campers, and other users (Murphy 2002a). The effects of repeated human travel in *Spiranthes diluvialis* habitat are similar to those of cattle-trampled vegetation (lightly used areas) or bare, compacted soil (heavily used areas). The number of obvious recently used human foot trails was measured both in the sample blocks and at the landscape scale. These human trails can be difficult to distinguish from cattle trails, but they are often associated with campsites or boat landings.

10) Campsite impacts: Sites used for tents, kitchens, fire rings, boat landings, or other activities (e.g., bathrooms or firewood gathering) also occasionally occur in *Spiranthes diluvialis* habitat (Moseley 2002; Murphy 2002a, 2002b). Trampled vegetation and bare ground (soil and gravel, not generally rocks) obviously exposed by recent human camping related activities was measured both in the sample blocks and at the landscape scale.

Other Human Caused Ground Disturbance:

11) Roads, houses, excavation, filling, heavy equipment use, fire fighting, etc.: Because *Spiranthes diluvialis* is a federally protected species, these potentially destructive activities are uncommon within its habitat. Ground disturbing activities are more common in the landscape surrounding occupied *Spiranthes diluvialis* habitat. They indicate the encroachment of development and other potential threats to habitat (e.g., weed invasion, vehicle travel, etc.). Ground disturbing activities were measured both in the sample blocks and at the landscape scale. Flood control activities were measured in the "Alteration of Floodplain" section).

Fire:

12) Wildfire: Human or naturally ignited fires, though rare in riparian settings, may directly kill *Spiranthes diluvialis* or indirectly impact *Spiranthes* through altering vegetation succession (positively or negatively or other site characteristics) (Murphy 2002b). The intensity of recent, noticeable burns was measured both in the sample blocks and at the landscape scale. Vigorous herbaceous growth after a fire can quickly mask burns in riparian settings. Charred stumps of trees and shrubs, as well as a blackened, ashy soil surface, are indicators of recent burns.

<u>*Confirmed Direct Loss of Spiranthes diluvialis Individuals*</u>:

13) Herbicide spraying, human harvest, disease, or other mortality causes: Dead *Spiranthes diluvialis* are difficult, or impossible, to observe and the cause of death may be unknown. Herbicide spraying is the most obvious and measurable (but rare) possible cause, but human harvest can also occur (e.g., wildflower picking, medicinal use, propagation, etc.). The amount of herbicide spraying in the sample blocks was measured.

<u>*Wildlife Activity*</u>:

14) Ungulate bedding, trampling, trails, grazing, and shrub browsing; beaver wood cutting and piling: Wildlife trampling, trailing, bedding, and grazing may have a detrimental short-term impact on *Spiranthes diluvialis* (most noticeable in areas ungrazed by livestock) (Moseley 1998). However, ungulate browsing and beaver activity may positively benefit *Spiranthes diluvialis* by opening shrub or tree canopies and reducing woody cover. It is difficult to measure the impacts of wildlife activity. The level of wildlife activity in the sample blocks was measured.

***INDIRECT THREATS AND CHANGES TO HABITAT:**

<u>*Vegetation Succession*</u>:

15) Competition by tall or invasive forbs (other than noxious weeds): Forb species, both native and exotic, are commonly associated with *Spiranthes diluvialis* and most do not pose a short-term threat. However, increases in cover of potentially competitive forbs (e.g., *Glycyrrhiza lepidota* (licoriceroot), *Medicago lupilina* (black medic), or *Trifolium* species (clover)) may alter habitat conditions necessary for *Spiranthes diluvialis* survival (Moseley 1998, 2002; Murphy 2002b). The total cover of all forb species in the sample block was measured. Noxious weeds were not considered here, but other weedy species were. *Equisetum* species (scouringrush) were also excluded because they are often associated with *Spiranthes diluvialis* and do not pose a long-term, detrimental competitive threat.

16) Competition by shrubs and trees: *Spiranthes diluvialis* does occur in the partial shade of overstory shrubs and trees, but never in complete shade. Over time, increased cover of shrubs and trees may alter the light and other environmental conditions necessary for *Spiranthes diluvialis* survival. The total cover of all woody species in the sample block was measured (individuals did not have to be rooted within the block).

<u>*Alteration of Floodplain*</u>:

17) Levees, rip-rapping, culverts, bridges, causeways, diversions, or other development that alters the hydrology or fluvial geomorphology of the river: The alteration of flood flows, as well as deposition and erosion processes, likely affects the long-term creation and loss of *Spiranthes diluvialis* habitat (Moseley 2002; Murphy 2002a). Alteration of the floodplain also affects groundwater tables that influence *Spiranthes diluvialis* habitat. The presence or absence of physical structures altering the floodplain of the surrounding landscape was measured.

******SPIRANTHES DILUVIALIS*** **CONSERVATION INFORMATION:**

<u>*Population Information*</u>:

18) Population tally: The number of *Spiranthes diluvialis* present in the sample blocks is not a clear indicator of any specific habitat condition. However, *Spiranthes diluvialis* populations likely respond to habitat changes. The size of the *Spiranthes diluvialis* population was categorized in four population classes.

19) Exclosures, fences, or other measures (including biocontrol insects on noxious weeds): The BLM and Caribou-Targhee National Forest have implemented measures to protect *Spiranthes diluvialis* at several occurrences. In the past, these have been in the form of exclosures or fences to protect plants from livestock grazing, OHVs, or human traffic. More recently, agencies have released biological control insects for noxious weeds. The presence or absence of functioning protective measures along, and adjacent to, the transect were measured.

RESULTS AND DISCUSSION

Transect Establishment and Environmental Description Data -Twenty-three habitat change monitoring transects were established at 18 *Spiranthes diluvialis* occurrences between August 14 and August 29, 2001. Photographs were taken and the Transect Establishment and Environmental Description Data Form and Habitat Monitoring Tally Sheet were completed for each transect at the time of establishment. Completed copies of these two field forms are stored at the CDC, BLM, and USFS and are available upon request. Table 1 summarizes the establishment data and environmental setting for each transect. To sufficiently monitor larger occurrences, with multiple community types, conditions, and/or threats, two transects were established. Occurrences with two transects were Warm Springs Bottom (003), Falls Campground (004), Lufkin Bottom (011), and Pine Creek #3 and #4 (016). Overall, transect lengths varied from 20 to 50 m, depending on the habitat patch size or site-specific threats at each chosen location for monitoring. Eighteen transects had lengths of 20, 25, or 30 m. Due to the narrow, linear nature of habitat at Mud Creek Bar (009) and Gormer Canyon #3 (021), the total width of the belt transect was 5 m (i.e., 2.5 m on each side), instead of the normal 10 m width (i.e., 5 m each side). The number of sample blocks per unit length (one block every 5 m) was unchanged by decreasing the width, but the total area sampled was decreased by one half.

The plant communities traversed by the belt transects were determined by quick visual estimates of the most dominant plant species. Often, environmental gradients cause intergradations of plant communities, making community delineation difficult. The heterogeneity of *Spiranthes diluvialis* habitat was illustrated by the 18 transects which traverse two or more community types (Table 1). Mesic graminoid communities were most commonly traversed, especially turf communities dominated by *Agrostis stolonifera* (redtop) and *Poa pratensis* (Kentucky bluegrass) (but *Carex lanuginosa* (woolly sedge) dominated patches were also abundant). *Elaeagnus commutata* (silverberry) communities were most common in, but not limited to, the upstream half of the section of the South Fork supporting *Spiranthes diluvialis*. *Salix exigua* (coyote willow)/mesic graminoid communities were nearly equally as commonly traversed as *Elaeagnus commutata* communities.

There were no apparent relationships between fluvial landforms on which the transect was located and the plant communities traversed (Table 1). At several transects the primary setting was adjacent to an abandoned meander/oxbow or a backwater slough; evidence of seasonal or temporary flooding was also present. Such fluvial landform settings were secondarily classified as flood overflow channels. Only one transect (Mud Creek Bar (009)) was located on an actively eroding cutbank (on a terrace immediately adjacent to the main river channel). Ten transects were located within 75 m of either the main river channel or a larger secondary river channel where fluvial geomorphic processes (e.g., erosion, deposition, channel migration, flooding) are most active and frequently occur. However, only two of those sites (Lufkin Bottom (011A) and Black Canyon (022)) appear to flood relatively frequently (though not every year). Numerous sites were seasonally or temporarily flooded from sub-irrigation. Three transects (Warm Springs Bottom (003A) and both at Annis Island (006A and B)) were located on landforms created by human disturbance (e.g., borrow pits for levee or dam construction). The two Annis Island (006A and B) transects were the only ones isolated from the current floodplain by levees. Surface soil types were difficult to identify without digging below the duff layer. Evidence of the June 1997 flood (e.g., sand, cobble, or woody debris deposits) was documented at, or adjacent to, nine transects, but in variable amounts (typically trace deposits).

Table 1. A summary of the transect establishment data and environmental setting of each habitat monitoring transect.

Occurrence (Transect Number)	GPS Coordinates of Transect Start (UTM: E, N)	Transect Length (m)	Transect Bearing (degrees)	Plant Communities Traversed by Transect	Fluvial Landforms Where Transect is Located
Kelly's Island (001)	446571, 4830305	25	4	*Elaeagnus commutata; Carex lanuginosa; Eleocharis rostellata*	floodplain wetland; flood overflow channel, without perennial water
Rattlesnake Point (002)	459683, 4827762	30	135	*Salix exigua/* mesic graminoid; *Agrostis stolonifera-Poa pratensis*	main river channel bank; fluvial terrace
Warm Springs Bottom (003A)	462240, 4827118	25	27	*Salix exigua/* mesic graminoid; *Carex lanuginosa; Agrostis stolonifera-Poa pratensis*	spring-fed channel; flood overflow channel w/perennial water; fluvial terrace; borrow pit
Warm Springs Bottom (003B)	462356, 4826784	40	330	*Salix exigua/* mesic graminoid; *Carex lanuginosa; Agrostis stolonifera-Poa pratensis*	abandoned meander, without perennial water; flood overflow channel
Falls Campground (004A)	471197, 4808799	35	248	*Elaeagnus commutata; Carex lanuginosa*	abandoned meander/oxbow, without perennial water; flood overflow channel
Falls Campground (004B)	470389, 4809138	20	265	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	flood overflow channel, without perennial water; depositional/aggrading area
Railroad Island (005)	439625, 4834817	20	126	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; fluvial terrace
Annis Island (006A)	426330, 4844712	40	324	*Populus angustifolia/* mesic graminoid; *Salix exigua/* mesic graminoid; *Carex lanuginosa*	abandoned meander/oxbow, with perennial water; floodplain wetland; borrow pit
Annis Island (006B)	426566, 4844956	30	283	*Agrostis stolonifera-Poa pratensis; Carex lanuginosa; Equisetum variegatum*	abandoned meander/oxbow, with perennial water; floodplain wetland; borrow pit
Twin Bridges (007)	438187, 4835832	25	304	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; fluvial terrace
Lorenzo Levee (008)	no transect established	n/a	n/a	n/a	n/a
Mud Creek Bar (009)	457712, 4828524	20	131	*Agrostis stolonifera-Poa pratensis*	main river channel bank; eroding cutbank; fluvial terrace
TNC Island (010)	459402, 4827718	25	290	*Agrostis stolonifera-Poa pratensis; Equisetum laevigatum*	backwater slough; flood overflow channel, with perennial water
Lufkin Bottom (011A)	462937, 4825367	50	294	*Salix exigua/* mesic graminoid; *Equisetum variegatum*	secondary river channel bank; flood overflow channel; fluvial terrace
Lufkin Bottom (011B)	463031, 4825239	30	81	*Agrostis stolonifera-Poa pratensis*	backwater slough; fluvial terrace

Table 1 continued. A summary of the transect establishment data and environmental setting of each habitat monitoring transect.

Occurrence (Transect Number)	GPS Coordinates of Transect Start (UTM: E, N)	Transect Length (m)	Transect Bearing (degrees)	Plant Communities Traversed by Transect	Fluvial Landforms Where Transect is Located
Gormer Canyon #5 (012)	no transect established	n/a	n/a	n/a	n/a
Gormer Canyon #4 (013)	464116, 4824245	20	51	*Salix exigua*/ mesic graminoid	main river channel bank; fluvial terrace
Pine Creek #5 (014)	464821, 4817820	30	180	*Salix exigua*/ mesic graminoid; *Salix lutea*/mesic graminoid; *Equisetum variegatum*	flood overflow channel, without perennial water; floodplain wetland
Archer Powerline (015)	no transect established	n/a	n/a	n/a	n/a
Pine Ck. #3 & #4 (016A)	465119, 4816451	30	329	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis*	abandoned meander/oxbow, without perennial water; flood overflow channel
Pine Ck. #3 & #4 (016B)	465368, 4816197	40	90	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; floodplain wetland
Lower Conant (017)	465352, 4814364	25	213	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis*	abandoned meander/oxbow, without perennial water; flood overflow channel
Upper Conant (018)	465818, 4812169	20	262	*Elaeagnus commutata*	abandoned meander/oxbow, without perennial water; flood overflow channel
Lower Swan Valley (019)	470819, 4809530	25	253	*Elaeagnus commutata*	secondary river channel bank; fluvial terrace
Squaw Creek Islands (020)	no transect established	n/a	n/a	n/a	n/a
Gormer Canyon #3 (021)	464078, 4823568	25	305	*Salix exigua*/ mesic graminoid; *Equisetum variegatum*	spring-fed channel; flood overflow channel, with perennial water; fluvial terrace
Black Canyon (022)	462557, 4826148	20	211	*Salix exigua*/ mesic graminoid; *Equisetum variegatum*	alluvial/point bar; flood overflow channel, with perennial water

Habitat Conditions at the Population Scale -Table 2 summarizes the mean values for each habitat attribute measured at the population, or transect scale, as well as the cumulative mean of all attributes. The apparent population trend at the occurrence was also included, determined from the 2001 status report (Murphy 2002b). In general, there was no apparent relationship between population trend and the cumulative mean for the transect. If attributes representing natural, or non-human related, habitat changes (i.e., deposition, cover, fire, wildlife impacts, cover of mesic graminoids, forbs, and woody species, and *Spiranthes diluvialis* population tally) were removed from the analysis, the new cumulative mean values (representing predominantly human caused changes) also did not reveal any relationships with population trend.

Hydrologic and Fluvial Geomorphic Change—Deposition and Loss of Soil Moisture: Only seven transects had more than trace evidence of recent alluvial deposition (nearly always sand, cobble, or woody debris deposits from June 1997) (Table 2). Deposits averaging at least 5 cm deep were most extensive along the Falls Campground (004B) and Mud Creek Bar (009) transects. Mesic graminoid cover below 40% was recorded in sample blocks at 14 transects, but only two averaged less than 40% cover of mesic graminoid species for the whole transect (Pine Creek #5 (014) and Gormer Canyon #3 (021)). Visually estimating the difference between 30% and 40% cover can be difficult for some observers and some observer bias may be introduced at this point. Deposition and loss of soil moisture are sometimes related. For example, a large amount of recent sand deposition may decrease the mesic graminoid cover, as occurred at Railroad Island (005) and Mud Creek Bar (009). However, mesic graminoid cover may also be decreased by drought or competition (from invasive and noxious weeds, forbs, and woody species). For example, Gormer Canyon #3 (021) had relatively low mesic graminoid cover, but had moderately high cover of noxious weeds (especially *Cirsium arvense* (Canada thistle)), forbs (mainly *Glycyrrhiza lepidota* (licorice root)), overhanging shrubs (including *Juniperus scopulorum* (Rocky Mountain juniper)), and occasional boulders. Future data collected for mesic graminoid cover will decrease the amount of error associated with observer bias or yearly weather fluctuations.

Invasive and Noxious Weeds: Twenty-two of the 23 transects surveyed had values over zero for the invasive and noxious weeds attribute (Table 2). Of these 22 transects, four had invasive species (aggressive but not noxious weeds designated under Idaho's Noxious Weed Law), such as *Cirsium vulgare* (bull thistle), *Phalaris arundinacea* (reed-canary grass), and exotic hay grasses. Eighteen transects had noxious weeds (often in addition to other invasive species). The only transect lacking both invasive and noxious weeds was Lower Conant (017). *Cirsium arvense* (Canada thistle) was ubiquitous, being observed at nearly all transects with noxious weeds. *Sonchus arvensis* (perennial sowthistle) was nearly as common (especially on moister ground). *Centaurea maculosa* (spotted knapweed), followed by *Carduus nutans* (musk thistle), was the next most common noxious weed (both observed at two transects each). *Centaurea diffusa* (diffuse knapweed) and *Euphorbia esula* (leafy spurge) (previously documented as threats at several sites (Murphy 2001)) have not yet invaded *Spiranthes diluvialis* habitat at any transect; they are usually nearby on slightly drier soil. The following nine transects had noxious and invasive weeds at relatively high levels (averaging over 10% cover for the whole transect): Kelly's Island (001) (mainly *Sonchus arvensis*); Rattlesnake Point (002); Warm Springs Bottom (003A); Falls Campground (004B); Railroad Island (005); TNC Island (010); Lufkin Bottom (011A); Gormer Canyon #3 (021); and Black Canyon (022). A potential relationship between high cover of noxious weeds and decreasing population trend was identified at Kelly's Island (001), Railroad Island (005), and TNC Island (010). Monitoring over time must occur to confirm any correlations.

Invasion by noxious weeds and other potentially competitive exotic species (especially tall forbs such as *Tanacetum vulgare* (common tansy) are symptomatic of other soil disturbing activities and ecological factors (Moseley 2002; Murphy 2002b). For example, Rattlesnake Point (002), Warm Springs Bottom (003A), and Falls Campground (004B) are seasonally grazed by cattle. TNC Island (010) and Lufkin Bottom 011A) are occasionally trampled by humans (campers and boaters). Gormer Canyon #3 (021) has a major wildlife trail along the transect. Black Canyon (022) is occasionally disturbed by flooding. To slow or reverse the spread of noxious weeds on the South Fork, the BLM has released biological control agents for *Cirsium arvense* (*Larinus planus*), *Centaurea* species (e.g., *Chpho cleonus achates*, *Larinus minutus*), and *Euphorbia esula* (e.g., *Aphthona lacertosa*) (Murphy 2002b). Transects with biological control agents introduced are Annis Island (006), Mud Creek Bar (009), Gormer Canyon #5 (012), Pine Creek #3 and #4 (016), and Gormer Canyon #3 (021) in 2001. In addition, the BLM released 21 other colonies of insects along the South Fork from Swan Valley to the confluence with the Henrys Fork. The Caribou-Targhee National Forest has also released biological control agents and used mechanical control (pulling) on some other potentially aggressive exotic species. Biological control agents are still being tested for *Sonchus arvensis*. The BLM will continue to release biological control agents along the South Fork in 2002, pending their availability. It is too early to assess the success of biological control efforts. In general, holistic management is required to prevent the spread of noxious weeds and competitive exotic species in Ute ladies' tresses populations.

<u>*Livestock Grazing Impacts—Hoofprints and Scat Piles Forage Utilization Trails and Bedding*</u>: Ten transects, at six occurrences, are currently seasonally grazed by cattle (Table 2). In addition, Railroad Island (005) is rarely grazed by cattle. As evidenced by the means of all categories of livestock grazing impacts (quantity of hoofprints and scat, amount of forage utilization at time of *Spiranthes diluvialis* surveys, and number of trails and bedding sites), Rattlesnake Point (002) was the most intensively grazed, followed by Warm Springs (003A and B). Late-season trespass cattle grazing occurred at Warm Springs Bottom (003) in 2001 (Murphy 2002b). Cattle were also documented at the Falls Campground (004) occurrence prior to the authorized season of use in 2001 (Murphy 2002b). Late season grazing increases the chance of direct grazing and trampling of plants, which in turn, poses a long-term threat due to decreased reproduction. The BLM and the USFS increased grazing allotment compliance inspections in 2001 due to drought conditions, especially for riparian/wetland areas, to ensure compliance with the permitted season of use (Murphy 2002b). This prevented any trespass grazing at the Annis Island (006), the Pine Creek occurrences, Mud Creek Bar (009), and Rattlesnake Point (002). Forage utilization was less at the Annis Island and Pine Creek transects because grass regrowth had occurred since cattle were removed. Inspections found that the Rattlesnake Point (002) area failed to meet grazing standards for stubble height in 2001. The pasture will be rested in 2002. The BLM will continue allotment compliance inspections in 2002. The BLM also denied requests for livestock grazing extensions in the fall of 2000 and spring of 2001 at the Pine Creek occurrences (the Five-ways Allotment). In addition, a draft Environmental Assessment (EA) was completed by the U.S. Forest Service (USFS) for the Moody, South Fork, and Burns Allotments. The preferred alternative in the EA includes continuing grazing at the Warm Springs Bottom pasture in the spring (with the cattle off by July 1) and fencing off the Rattlesnake Point area from cattle grazing. Future monitoring will track the changes to *Spiranthes diluvialis* habitat resulting from decreased livestock grazing.

<u>*Off-highway Vehicle Use Impacts*</u>: No off-highway vehicle (OHV) use was documented along any *Spiranthes diluvialis* habitat monitoring transects this year (Table 2). The BLM implemented motorized vehicle closures at Kelly's Island (001), Warm Springs Bottom (003), and Mud Creek Bar (009) in June (Murphy 2001). However, at Mud Creek Bar (009) an OHV route was established, in violation of the closure, to access an unauthorized outfitter camp. Fortunately, the OHV route was about 15 to 20 m away from *Spiranthes diluvialis* habitat and did not cross the transect. The OHV barriers at Warm Springs Bottom (003) and Mud Creek Bar (009) will be re-constructed in 2002. In addition to the motorized vehicle closures mentioned above, the BLM also implemented closures at four other areas along the South Fork in 2001.

<u>*Recreation—Human Trails and Camping Impacts*</u>: Seven transects had human recreation trails through *Spiranthes diluvialis* habitat, and three of those had associated campsite impacts (e.g., other trampling related to tent sites, fire rings, kitchens, boat landings, etc.) (Table 2). In addition, Annis Island (006B) had signs of old firewood cutting, but no recent recreation impacts. Portions of the TNC Island (010) and Lufkin Bottom (011A) transects annually experience trampling of habitat by campers, boaters, and anglers. No trampled plants were observed this year, but there is a risk of future direct trampling as recreation use continues. An unauthorized outfitter camp, with heavy human trampling, was established

less than 15 m away from occupied habitat at Mud Creek Bar (009) (Murphy 2002b). A trail from the boat landing to the camp went directly through occupied habitat and across the transect. Though no trampled plants were confirmed, the possibility of trampling was high and the long-term impacts to the habitat will be monitored (Murphy 2002b). During 2001, the BLM and USFS initiated weekly to bi-weekly river patrols on the upper South Fork to maintain dispersed camp areas, to ensure compliance with regulations, and to increase information contacts with river users. The BLM also conducted a visitor use survey at upper South Fork boat access areas to, in part, explore visitors' attitudes toward sensitive species and other river use issues.

<u>Other Human Caused Ground Disturbance</u>: No recent ground disturbance was documented at any transect (Table 2). Some soil deposition, derived from an old dam (now breached), has occurred along the margin of *Spiranthes diluvialis* habitat at Warm Springs Bottom (003A).

<u>Fire</u>: A human-ignited wildfire burnt a portion of the Annis Island (006A) transect during late spring (Table 2). A mosaic pattern of intensity, from lightly burning the duff layer to full removal of the duff layer, was observed within the habitat burned (Murphy 2002b). *Spiranthes diluvialis* was documented blooming within areas lightly burnt, though it was difficult to draw any conclusions regarding the long-term benefit or harm of the fire without further monitoring. The BLM monitored the post-fire vegetation recovery in summer 2001.

<u>Confirmed Mortality of *Spiranthes diluvialis*—Herbicide Spraying or Other</u>: No confirmed mortality of *Spiranthes diluvialis* was observed at any transect (Table 2). No herbicide spraying in *Spiranthes diluvialis* habitat was observed in 2001.

<u>Wildlife Impacts</u>: Eighteen of 23 transects had measurable impacts from wildlife, such as ungulate bedding, trampling or trails, and shrub browsing (Table 2). Impacts were generally minimal and not widespread. Only Gormer Canyon #3 (021) had heavy impacts, due to a wildlife trail paralleling the transect. The impacts of wildlife activity to *Spiranthes diluvialis* habitat, positive or negative, are not clearly known. More monitoring is required to induce any relationships.

<u>Vegetation Succession—Competition by Forbs, Shrubs, and Trees</u>: Twenty-one of the 23 transects had measurable forb cover exceeding the zero class, though only eight averaged between 30 and 50% cover for the entire transect (Table 2). Transects with forb cover averaging over 30% usually had high cover of *Glycyrrhiza lepidota* (licoriceroot), *Medicago lupilina* (black medic), and/or *Trifolium* species (*T. pratense* (red clover) and *T. repens* (white clover)). Such was the case at Rattlesnake Point (002), Warm Springs Bottom (003A and B), Annis Island (006A and B), and Pine Creek #3 and #4 (016A and B). These three occurrences are annually grazed in the spring and early summer. The soil disturbed by cattle grazing may facilitate invasion by leguminous forb species. Grazing can also release these forbs from competition with mesic graminoid species.

Measurable shrub and tree cover exceeding the zero class (over 1% cover) was documented at all 23 transects (Table 2). At Rattlesnake Point (002), Warm Springs Bottom (003A), Falls Campground (004A), Annis Island (006A), Gormer Canyon #4 (013), Lower Swan Valley (019), and Black Canyon (022) the average cover of woody species was about 10% or more. The cover classes chosen for this habitat attribute may have been too low. However, at all but a few transects there was room for measuring increases in shrub and tree cover over time (Table 2). In addition, observers may have over-estimated shrub and tree cover in the sample blocks. At this point, I hesitate to alter the cover classes for this attribute. Additional data collection may reduce error associated with observer bias. It is also possible that the shrub and tree cover attribute may be less important for determining "ideal" *Spiranthes diluvialis* habitat than previously thought.

Table 2. Mean values for habitat attribute types* calculated for all sample blocks at each transect. The cumulative mean of all attributes, as well as population trend, for each transect is also included.

Occurrence (Transect Number)	Apparent Population Trend (at least 3 consecutive years in same direction)	Transect Length (m) (n = # of sample blocks)	Direct Changes/Threats						
			Hydrologic and Fluvial Geomorphic Change		Invasive & Noxious Weeds	Livestock Grazing Impacts			OHV Use
			Deposition	Loss of soil moisture	Invasion & colonization by weedy species	Hoofprints & scat piles	Forage utilization	Trails & Bedding	Tracking & trailing
Kelly's Island (001)	decreasing?	25 (n = 10)	0.00	0.00	1.90	0.00	0.00	0.00	0.00
Rattlesnake Point (002)	unknown	30 (n = 12)	0.50	0.17	1.50	1.00	1.25	0.50	0.00
Warm Spgs Bottom (003A)	unknown	25 (n = 10)	0.00	0.00	1.10	0.90	0.80	0.90	0.00
Warm Spgs Bottom (003B)	unknown	40 (n = 16)	0.00	0.00	0.88	1.00	0.75	0.13	0.00
Falls Campground (004A)	unknown	35 (n = 14)	0.14	0.21	0.43	0.57	0.21	0.71	0.00
Falls Campground (004B)	unknown	20 (n = 8)	1.00	0.50	1.38	0.25	0.00	0.50	0.00
Railroad Island (005)	decreasing?	20 (n = 8)	0.75	0.75	1.00	0.13	0.00	0.00	0.00
Annis Island (006A)	unknown	40 (n = 16)	0.00	0.00	0.25	1.00	0.13	0.44	0.00
Annis Island (006B)	unknown	30 (n = 12)	0.00	0.00	0.92	1.67	0.00	0.08	0.00
Twin Bridges (007)	decreasing	25 (n = 10)	0.00	0.50	0.60	0.00	0.00	0.00	0.00
Mud Creek Bar (009)	decreasing?	20 (n = 8)*	1.00	0.88	0.25	0.00	0.00	0.00	0.00
TNC Island (010)	decreasing?	25 (n = 10)	0.00	0.40	1.20	0.00	0.00	0.00	0.00
Lufkin Bottom (011A)	unknown	50 (n = 20)	0.00	0.40	1.45	0.00	0.00	0.00	0.00
Lufkin Bottom (011B)	unknown	30 (n = 12)	0.00	0.00	0.50	0.00	0.00	0.00	0.00
Gormer Canyon #4 (013)	unknown	20 (n = 8)	0.00	0.13	0.50	0.00	0.00	0.00	0.00
Pine Creek #5 (014)	unknown	30 (n = 12)	0.08	1.00	0.25	0.67	0.00	0.00	0.00
Pine Ck. #3 & #4 (016A)	unknown	30 (n = 12)	0.00	0.00	0.25	1.00	0.00	0.25	0.00
Pine Ck. #3 & #4 (016B)	unknown	40 (n = 16)	0.00	0.81	0.81	0.88	0.00	0.00	0.00
Lower Conant (017)	decreasing?	25 (n = 10)	0.00	0.70	0.00	0.00	0.00	0.00	0.00
Upper Conant (018)	decreasing	20 (n = 8)	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Lower Swan Valley (019)	increasing?	25 (n = 10)	0.00	0.00	0.70	0.00	0.00	0.00	0.00
Gormer Canyon #3 (021)	unknown	25 (n = 10)*	0.00	1.40	1.00	0.00	0.00	0.00	0.00
Black Canyon (022)	unknown	20 (n = 8)	0.00	0.88	1.75	0.00	0.00	0.00	0.00
Total # of Transects with Value >0 in Catagory			7	14	22	11	5	8	0

* The attribute types and numeric values correspond with those in the "*Spiranthes diluvialis* Habitat Monitoring Checklist" (Appendix 3). The numeric values represent classes (e.g., 0, 1, or 2, except for the population tally attribute which was 0, 1, 2, or 3) that reflect different measurable habitat conditions. The zero class is closest to ideal habitat conditions; the higher the number, the less ideal the current habitat conditions are.

Table 2 continued. Mean values for habitat attribute types calculated for all sample blocks at each transect.

Direct Changes/Threats continued						Indirect Changes			Total Values for Site (sum of results for each category)	Mean for Site (tot./16/n)
Recreation		Other Human Ground Disturbance	Fire	Confirmed Mortality	Wildlife Activity	Vegetation Succession		Population Information		
Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire, human or natural	Herbicide spraying or other mortality	Ungulate bedding, trails, browsing; beaver use	Competition by tall or invasive forbs	Competition by shrubs & trees	Population tally		
0.00	0.00	0.00	0.00	0.00	0.70	0.00	1.00	2.80	64.00	0.40
0.00	0.00	0.00	0.00	0.00	0.75	1.00	1.75	2.50	131.00	0.68
0.50	0.00	0.30	0.00	0.00	0.40	1.20	1.70	2.60	104.00	0.65
0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.88	1.63	100.00	0.39
0.07	0.00	0.00	0.00	0.00	0.36	0.43	1.93	2.93	112.00	0.50
0.50	0.00	0.00	0.00	0.00	0.88	0.63	1.38	2.75	78.00	0.61
0.00	0.00	0.00	0.00	0.00	0.25	0.13	1.50	3.00	60.00	0.47
0.00	0.00	0.00	0.75	0.00	0.31	1.25	1.75	2.25	130.00	0.51
0.00	0.50	0.00	0.00	0.00	0.00	1.08	0.50	2.17	83.00	0.43
0.00	0.00	0.00	0.00	0.00	0.50	0.30	1.50	2.10	55.00	0.34
1.63	0.38	0.00	0.00	0.00	0.00	0.13	1.38	2.75	67.00	0.53
0.80	0.20	0.00	0.00	0.00	0.00	0.30	0.80	2.70	64.00	0.40
0.10	0.15	0.00	0.00	0.00	0.00	0.55	0.65	2.05	107.00	0.33
0.00	0.00	0.00	0.00	0.00	0.58	0.50	0.67	2.58	58.00	0.30
0.13	0.00	0.00	0.00	0.00	0.63	0.00	1.75	2.63	46.00	0.36
0.00	0.00	0.00	0.00	0.00	0.17	0.25	1.42	2.67	78.00	0.41
0.00	0.00	0.00	0.00	0.00	0.17	1.50	1.17	2.83	87.00	0.45
0.00	0.00	0.00	0.00	0.00	0.13	1.31	1.06	2.56	121.00	0.48
0.00	0.00	0.00	0.00	0.00	0.60	0.70	1.20	2.70	59.00	0.37
0.00	0.00	0.00	0.00	0.00	0.88	0.63	1.00	2.88	45.00	0.35
0.00	0.00	0.00	0.00	0.00	0.80	0.60	1.80	2.60	65.00	0.41
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.10	2.40	79.00	0.49
0.00	0.00	0.00	0.00	0.00	0.13	0.38	2.00	1.75	55.00	0.43
7	4	1	1	0	18	21	23	23		

Population Information—Population Tally: The above ground population of *Spiranthes diluvialis* observed along the belt transect is not a direct measure of habitat conditions. However, the annual population tally is related to overall habitat conditions. It is impossible to identify any relationships from the first year baseline habitat data, but future monitoring may reveal correlations between changes in observable *Spiranthes diluvialis* numbers and changes in specific habitat attributes. The above ground population of *Spiranthes diluvialis* observed each year is highly variable, probably reflecting annual climate fluctuation, prolonged dormancy, and shifting phenology. Warm Springs Bottom (003B) and Black Canyon (022) had the most *Spiranthes diluvialis* observed along the belt transect, averaging over 10 plants per sample block (Table 2). Railroad Island (005) was the only transect with zero *Spiranthes diluvialis* plants observed.

Habitat Conditions at the Landscape Scale: Landscape level assessments are most useful for assessing the risk of, or potential for, direct impacts to *Spiranthes diluvialis* habitat rather than magnitude of impacts. Table 3 summarizes the values measured for landscape level attributes at each transect. The transects with the highest cumulative values for landscape attributes were Kelly's Island (001), Warm Springs Bottom (003A), Annis Island (006A and B), Twin Bridges (007), and Mud Creek Bar (009). These transects all have widespread noxious weeds and are found in high use areas relatively close to established roads. This makes the habitat susceptible to impacts from OHV traffic and human recreation activities (e.g., mostly trails and campsites). In addition, most of the Annis Island occurrence is isolated from the current floodplain by large levees.

Hydrologic and Fluvial Geomorphic Change—Bank Erosion: Only the Mud Creek Bar (009) transect was at high risk of loss from bank erosion (Table 3). The transect center point was only 1.9 m from the active cutbank. Rattlesnake Point (002) was 12.1 m from a cutbank, but this bank does not receive the full force of the current and active erosion was limited.

Invasive and Noxious Weeds: Ten of the 23 transects had numerous small colonies of noxious weeds scattered within 100 m, while six transects had widespread, large colonies, of noxious weeds within l00 m (Table 3). As mentioned in the population level habitat conditions section, the BLM released biological control agents for *Cirsium arvense* (Canada thistle), *Centaurea* (knapweed) species, and *Euphorbia esula* (leafy spurge) at Annis Island (006), Mud Creek Bar (009), Gormer Canyon #5 (012), Pine Creek #3 and #4 (016), Gormer Canyon #3 (021), and elsewhere in 2001 (Murphy 2002b). The USFS also released biological control agents. No noticeable noxious weed colonies were observed within 100 m of the Falls Campground (004A), TNC Island (010), Pine Creek #5 (014), Upper Conant (018), Lower Swan Valley (019), and Gormer Canyon #3 (021). However, all of these transects, except Upper Conant (018), had noxious and/or invasive weeds present at the population level.

Off-highway Vehicle Use Impacts: OHV use occurred with 100 m of six transects (Table 3). Natural barriers (e.g., river channels, steep and brushy banks, etc.) or human constructed barriers were usually sufficient to protect all of these transects except possibly Annis Island (006B) (which was adjacent to a levee road, but does have limited access) from direct OHV impacts. At Mud Creek Bar (009), however, an OHV route, circumventing the constructed barrier, was established, in violation of the area closure. The Warm Springs Bottom OHV barrier had also been by-passed. The OHV barriers at Warm Springs Bottom (003) and Mud Creek Bar (009) will be reconstructed in 2002 to prevent this problem. The BLM implemented numerous motor vehicle closures along the South Fork in 2001.

Recreation—Human Trails and Campsite Impacts: Fifteen transects had at least one human trail within 100 m, but only three of those had heavy impacts or more than one trail in the nearby area (Falls Campground (004A), Mud Creek Bar (009), and TNC Island (010)) (Table 3). These trails were often (but not always) related to camping areas and boat landings. Ten transects were within 100 m of at least one campsite impact and two of those had more than two campsite impacts (Mud Creek Bar (009) and TNC Island (010)). An unauthorized outfitter camp, with heavy human trampling, was established less than 15 m away from the Mud Creek Bar (009) transect (Murphy 2002b). The relocation of the outfitter camp in 2002 should eliminate recreation impacts at Mud Creek Bar (009). In general, recreation impacts on the landscape level were most noticeable in the canyon stretch of the South Fork from the Lufkin Bottom area upstream past the Gormer Canyon area to the Pine Creek areas. The large number of transects in proximity to human trails and recreation sites underscores the risk of direct trampling of *Spiranthes diluvialis* and its habitat.

<u>Other Human Caused Ground Disturbance</u>: Fourteen of the 23 transects had some ground disturbing activities within 400 m (Table 3). Eight of those 14 transects had noticeable impacts, or more than one impact. The ground disturbances most commonly documented were existing roads (e.g., Warm Springs Bottom (003A), Annis Island (006A and B)) and developed campgrounds or recreation areas (e.g., Kelly's Island (001), Falls Campground (004A), Twin Bridges (007), Upper Conant (018)). The Lower Swan Valley (019) transect is within 400 m of a housing development in the floodplain. Roads and other floodplain development may not always directly impact *Spiranthes diluvialis* habitat, but development is often associated with increasing the risk of other threats (e.g., floodplain alteration, OHV use, weed invasion). In 2001 and 2002, the BLM Upper Snake/South Fork Snake River Land and Water Conservation Fund project acquired two conservation easements, totaling 738 acres, on private lands along the South Fork to prevent further subdivision and resort development (Murphy 2002b). The BLM Upper Snake/South Fork Snake River Land and Water Conservation Fund project is currently negotiating two more separate conservation easements on private lands along the South Fork of the Snake River. The results of these negotiations are dependent on FY2002 appropriations, as well as landowner willingness.

<u>Fire</u>: A human-ignited wildfire burnt a portion of the southwest edge of the Annis Island occurrence during late spring at transect (006A) (Table 3). See the population level habitat conditions section above for details.

<u>Alteration of the Floodplain</u>: Ten of the 23 transects had at least one physical structure impacting river hydrology within 400 m (Table 3). The Annis Island (006A and B) transects were isolated from the active floodplain by levees. Bank stabilizing rip-rap was observed within 400 m of the Railroad Island (005), Upper Conant (018), and Lower Swan Valley (019) transects. Road causeways, built over channels forced through culverts that restrict flood flows, were observed at the Kelly's Island (001) and Twin Bridges (007) transects. Alteration of the floodplain has effects on the pattern, duration, and intensity of floods and associated erosion and deposition. These fluvial geomorphic changes may also affect *Spiranthes diluvialis* populations and habitat. Floodplain alteration is often associated with other development (e.g., roads, housing, recreation sites).

<u>Population Conservation—Protection Measures</u>: Only the Falls Campground (004A and B) transects were located within 100 m of exclosures that protect the majority of the *Spiranthes diluvialis* sub-population in the area (Table 3). The exclosures at Kelly's Island (001) do not protect the majority of the *Spiranthes diluvialis* sub-population in the area. The current constructed OHV barriers at Warm Springs Bottom and Mud Creek Bar occurrences do not prevent all OHV entry to *Spiranthes diluvialis* habitat. The barriers will be reconstructed in 2002. The fence delimiting the campground area at Twin Bridges (007) prevents OHV access and possibly reduces human foot traffic to the main *Spiranthes diluvialis* habitat at this site.

Table 3. Values for habitat attribute types* measured at the landscape scale for each transect.

Occurrence (Transect #)	Direct Changes/Threats							Indirect Changes		Total (excluding Bank Erosion category)
	Hydrologic and Fluvial Geomorphic Change	Invasive & Noxious Weeds	Off-Highway Vehicle Use	Recreation		Other Human Caused Ground Disturbance	Fire	Alteration of Floodplain	Population Information	
	Bank Erosion (m to cutbank)	Invasion & colonization by noxious & invasive weeds	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire, human or naturally caused	Levees, rip-rapping, culverts, diversions, etc.	Exclosures, fences, biocontrol, other protection	
Kelly's Island (001)	n/a	2	0	1	0	2	0	1	1	7
Rattlesnake Point (002)	12.1	1	0	1	0	1	0	0	2	5
Warm Springs Bottom (003A	n/a	2	0	1	0	2	0	1	2	8
Warm Springs Bottom (003B)	n/a	1	0	0	0	1	0	1	2	5
Falls Campground (004A)	n/a	0	0	2	0	2	0	0	0	4
Falls Campground (004B)	n/a	2	1	1	0	0	0	0	0	4
Railroad Island (005)	n/a	1	0	0	0	0	0	1	2	4
Annis Island (006A)	n/a	2	0	0	0	2	1	2	2	9
Annis Island (006B)	n/a	2	1	0	1	2	0	2	2	10
Twin Bridges (007)	n/a	1	1	1	1	2	0	1	1	8
Mud Creek Bar (009)	1.9	1	2	2	2	1	0	0	2	10
TNC Island (010)	23.4	0	0	2	2	0	0	0	2	6
Lufkin Bottom (011A)	n/a	1	0	1	1	1	0	0	2	6
Lufkin Bottom (011B)	n/a	0	0	1	1	1	0	0	2	5
Gormer Canyon #4 (013)	n/a	1	0	1	1	0	0	0	2	5
Pine Creek #5 (014)	n/a	0	1	1	1	0	0	0	2	5
Pine Creek #3 & #4 (016A)	n/a	2	0	1	1	0	0	0	2	6
Pine Creek #3 & #4 (016B)	n/a	1	0	1	1	0	0	0	2	5
Lower Conant (017)	n/a	1	0	0	0	0	0	0	2	3
Upper Conant (018)	n/a	0	0	0	0	2	0	2	2	6
Lower Swan Valley (019)	30.5	0	0	0	0	2	0	2	2	6
Gormer Canyon #3 (021)	n/a	0	2	1	0	0	0	0	2	5
Black Canyon (022)	n/a	1	0	0	0	1	0	1	2	5
Total # of Transects with Value >0 in Category	4	16	6	15	10	14	1	10	21	

* The attribute types and numeric values correspond with those in the "*Spiranthes diluvialis* Habitat Monitoring Checklist" (Appendix 3). The numeric values represent classes (e.g., 0, 1, or 2, except for the bank erosion attribute which was an actual distance) that reflect different measurable habitat conditions. The zero class is closest to ideal habitat conditions at the landscape scale; the higher the number, the less ideal the current habitat conditions are.

CONCLUSIONS AND RECOMMENDATIONS

The methods developed for monitoring the habitat of *Spiranthes diluvialis* on the South Fork of the Snake River, Idaho, proved to be a relatively quick, easily repeatable, and objective way of measuring current habitat conditions. Transect establishment was the most time consuming procedure, while photo-point monitoring and habitat monitoring procedures took much less time. No major changes in the methodology are suggested for next years monitoring. The first year results using these methods were not radically different from results of prior habitat monitoring using subjective methods (Moseley 1998, 2002; Murphy 2002a, 2002b). However, unlike data collected with subjective methods, data collected using an index of habitat change forms a numerically determined baseline from which future *Spiranthes diluvialis* habitat changes and threats can be measured.

It is recommended that the index of habitat change monitoring method be utilized for at least the next two to four years of monitoring. Three to five years of data should be enough to test the ability of the method for measuring habitat changes. Any observer bias will also be dampened with additional data collection. It should be noted that the transects established in 2001 measure only a sub-sample of the entire habitat at most larger occurrences. Current transects may not adequately represent the overall condition of the entire occurrence; additional transects may need to be established. Unless transects are established at most sub-populations, occurrence-wide threat and condition observations must also continue. However, the transect monitoring data can be used as a valuable decision aid when determining future conservation actions.

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